# Mass Asymmetric Fission Barriers for Neutron-Rich and Neutron-poor Compound Nuclei $^{76,70}$Se

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Earlier work [1,2] by this group studied the mass asymmetric, conditional-fission barriers for the compound nuclei $^{75}$Br and $^{90,94,98}$Mo. In this work, complex fragment emission ($4 < Z < 21$) has been studied at over six bombarding energies for $^{76}$Se and $^{70}$Se produced in the reactions $^{64,58}$Ni + $^{12}$C, representing neutron-rich (n/p=1.24) and neutron-poor (n/p=1.06) nuclei of atomic number Z=34. Excitation functions have been constructed for each Z value. Mass asymmetric barriers have been extracted by fitting the measured excitation functions with a transition state formalism.

The experiment was performed at the 88-Inch Cyclotron of LBNL. To create the excited compound nuclei $^{76,70}$Se, a carbon target (1.0 mg/cm$^2$) was bombarded with beams of $^{64,58}$Ni at several energies ranging from 5.8 MeV/u to 14.1 MeV/u. The use of reverse kinematics provides a clear signature for the production of complex fragments by a binary-decay mechanism [3]. Eight $E-\Delta E$ telescopes, each consisting of a gas $\Delta E$ followed by a position-sensitive silicon detector, provided the energy, atomic number, and spatial location of each detected fragment. Velocity spectra were obtained for each fragment Z-species. The isotropic emission of complex fragments in the reaction plane can be seen from the decay of the two nuclei $^{76,70}$Se.

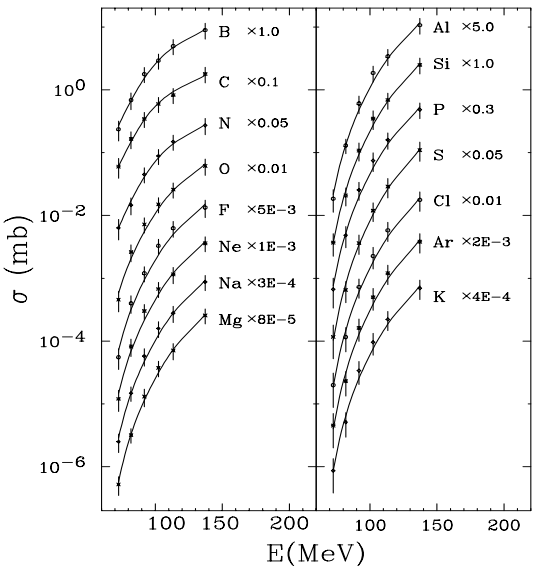


FIG. 1. Dependence of the total integrated cross section on the center-of-mass energy for emission of complex fragments from the reaction $^{64}$Ni + $^{12}$C. The curves are fits. The number to the right indicates the factor by which each curve and the set of experimental points are multiplied.

The $d\sigma/d\theta$ distributions in the frame of the source system were determined for all fragment Z-values. Angle-intergrated cross sections for the isotropic component were determined from the averaged $d\sigma/d\theta$ of the flat regions in the angular distributions. The charge distributions of complex fragments associated with fusion-like reactions at all the bombarding energies have been determined. The corresponding excitation functions for $^{64}$Ni + $^{12}$C are shown in fig. 1. Each excitation function was fitted with a conditional barrier $B_Z$ and the ratio of the level-density parameter at the saddle point to that of the ground state ($a_Z/a_n$). Fig. 2 illustrates the macroscopic conditional barriers and the ratios of level density parameters $a_Z/a_n$ for the compound nuclei $^{76,70}$Se. Comparison with macroscopic nuclear models and further analysis are underway.

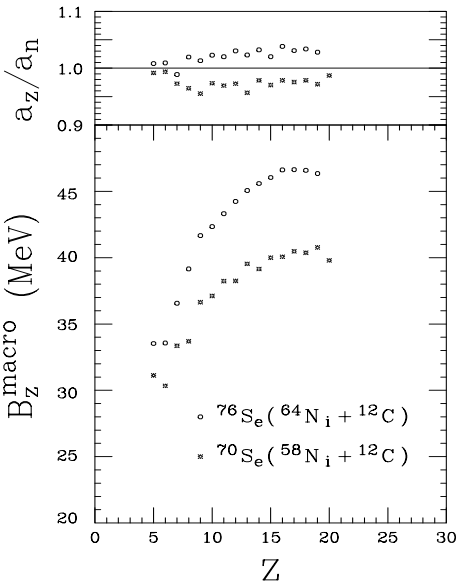


FIG. 2. Preliminary values of the mass-asymmetric fission barriers ($B_Z^{macro}$) , which corresponds to the mass difference between the saddle point and the spheric liquid drop, and the ratio of the level density parameters ($a_Z/a_n$) for compound nuclei $^{76,70}$Se, extracted from the fitting of the excitation functions.

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